indicate that attitudes among the medical profession and patients are changing.

There has been much discussion about clinical trials and informed consent,[4-6] and, though we believe that informed consent is mandatory, we accept that a proportion of patients do not enter trials because they may dislike the idea of a random decision being made about treatment or because they refuse or request one part of the random option offered. A further group of patients are excluded because they do not fulfil the entry criteria for the trial, and this group may be larger than forecast at the time the trial was planned. These factors may be the reason why accrual to the Scottish breast conservation trial has been slower than anticipated. The planned total intake was 900 patients, and after four years 420 patients had been entered.[2]

In conclusion more than half of the patients thought initially to be suitable for conservation were excluded from our trials and one third of the remainder refused to take part. Those planning prospective clinical trials should therefore take into account the loss of patients through ineligibility and refusal when predicting the accrual rate and overall duration of any proposed trial and the possible effects of this selection on conclusions drawn from the results.


1 De Vita VT. Breast cancer therapy: exercising all our options. *N Engl J Med* 1989;**320**:527-9.
2 Stewart HJ, Prescott RJ, Forrest APM. Conservation therapy of breast cancer. *Lancet* 1989;ii:168-9.
3 Wilson RG, Hart A, Dawes PJDK. Mastectomy or conservation: the patient's choice. *Br Med J* 1988;**297**:1167-9.
4 Brahams D. Medicine and the law. Randomised trials and informed consent. *Lancet* 1988;ii:1033-4.
5 Baum M, Zilkha K, Houghton J. Ethics of clinical research: lessons for the future. *Br Med J* 1989;**299**:251-3.
6 Brewin CR, Bradley C. Patient preferences and randomised clinical trials. *Br Med J* 1989;**299**:313-5.



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# Interaction between bedding and sleeping position in the sudden infant death syndrome: a population based case-control study


Peter J Fleming, Ruth Gilbert, Yehu Azaz, P Jeremy Berry, Peter T Rudd, Alison Stewart, Elizabeth Hall



## Abstract

***Objective*—To determine the relation between sleeping position and quantity of bedding and the risk of sudden unexpected infant death.**

***Design*—A study of all infants dying suddenly and unexpectedly and of two controls matched for age and date with each index case. The parents of control infants were interviewed within 72 hours of the index infant's death. Information was collected on bedding, sleeping position, heating, and recent signs of illness for index and control infants.**

***Setting*—A defined geographical area comprising most of the county of Avon and part of Somerset.**

***Subjects*—72 Infants who had died suddenly and unexpectedly (of whom 67 had died from the sudden infant death syndrome) and 144 control infants.**

***Results*—Compared with the control infants the infants who had died from the sudden infant death syndrome were more likely to have been sleeping prone (relative risk 8·8; 95% confidence interval 7·0 to 11·0; $p<0·001$), to have been more heavily wrapped (relative risk 1·14 per tog above 8 tog; 1·03 to 1·28; $p<0·05$), and to have had the heating on all night (relative risk 2·7; 1·4 to 5·2; $p<0·01$). These differences were less pronounced in the younger infants (less than 70 days) than the older ones. The risk of sudden unexpected death among infants older than 70 days, nursed prone, and with clothing and bedding of total thermal resistance greater than 10 tog was increased by factors of 15·1 (2·6 to 89·6) and 25·2 (3·7 to 169·0) respectively compared with the risk in infants of the same age nursed supine or on their side and under less than 6 tog of bedding.**

***Conclusions*—Overheating and the prone position are independently associated with an increased risk of sudden unexpected infant death, particularly in infants aged more than 70 days. Educating parents about appropriate thermal care and sleeping position of infants may help to reduce the incidence of the sudden infant death syndrome.**



**Institute of Child Health, Bristol BS2 8BJ**
Peter J Fleming, FRCP, *consultant paediatrician*
Yehu Azaz, MRCP, *research fellow*
Alison Stewart, SRN, *research midwife*

**Bath Unit for Research into Paediatrics, Bath BA1 3NG**
Ruth Gilbert, MRCP, *research fellow*
Peter T Rudd, MD, *consultant paediatrician*

**Bristol Maternity Hospital, Bristol BS2 8EG**
P Jeremy Berry, MRCPATH, *consultant paediatric pathologist*

**Royal United Hospital, Bath BA1 3NG**
Elizabeth Hall, FRCPATH, *consultant pathologist*

Correspondence to: Dr Peter Fleming, Department of Child Health, Bristol Maternity Hospital, Bristol BS2 8EG.



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## Introduction

The possible role of thermal stress in the aetiology of the sudden infant death syndrome has been suggested by many authors,[1-3] and Wailoo *et al* recently showed that many babies are put to bed under excessive amounts of bedding.[4] The low incidence of the sudden infant death syndrome in Hong Kong, which has a hot, humid climate but where most infants sleep supine, has led to the suggestion that the prone position may be an important risk factor.[5] Recently, Nelson *et al* suggested on the basis of a simple model of infant heat balance that infants sleeping in the prone position with an excess of bedding would be more likely to become hyperthermic than infants in the supine position with equal bedding.[6] We have shown an appreciable rise in oxygen consumption and carbon dioxide production (and hence heat production) between birth and 1 month of age in healthy infants.[7] This higher metabolic rate is maintained until at least 3 months. We have also shown that raising the environmental temperature around healthy infants aged 3 months or less increases respiratory oscillations, suggesting an effect on the respiratory control system.[8] Thus infants in this age range, which is the age of peak incidence of the sudden infant death syndrome, would be at increased risk of the consequences of overwrapping. The effects of overwrapping would be likely to be greater at the time of acute viral infection, when the metabolic rate rises, and two studies have shown that many parents in the United Kingdom and in New Zealand respond to infections in their babies by increasing the amount of clothing and bedding.[9,10]

To investigate the possible interactions between quantity of bedding and sleeping position in normal infants and in infants dying suddenly and unexpectedly we conducted a case-control study of all such infant deaths in a defined part of the counties of Avon and Somerset over 18 months. This study formed part of a prospective investigation of all infant deaths in the county of Avon, which will be reported in full elsewhere.

## Methods

We were notified of all sudden and unexpected deaths of infants (from birth to 1 year) in a defined area comprising most of the county of Avon and part of Somerset. On the day of an infant's death his or her general practitioner and health visitor were contacted. The health visitor was asked to identify from her caseload the two infants living in the same neighbourhood who were closest in age to the infant who had died. As part of a programme of support for bereaved families the parents of the dead baby were contacted and seen by one of us, usually at home and with either the general practitioner or health visitor, as soon as possible after the baby had died. We visited the parents on two to four further occasions over the next two to three months. A detailed, structured history was taken from the parents, including social factors, maternal medical history, family history, and details of the pregnancy and perinatal period. A full medical history of the dead baby was taken with emphasis on recent signs of illness, feeding, and sleeping. Precise details were collected of the infant's last sleep, with particular note of the time and position in which the baby had been put down, the position in which he or she had been found, the precise quantity and nature of the clothing and bedding, whether the baby had been swaddled, whether the bedclothes had been over the baby's head when found, what heating was in the baby's room, and the time the heating had been on. Medical records of both the mother and baby were used to obtain information on the pregnancy, perinatal period, and any subsequent problems, together with the infant's growth chart.

As soon as possible after the death of the index infant we visited the two control infants at home and took an exactly comparable detailed history, with particular reference to the 24 hours preceding the home visit. The control infants were weighed and microbiological samples taken for an investigation of the role of infection in the sudden infant death syndrome (to be reported in full elsewhere).[11]

Data were obtained from the Meteorological Office on the daily maximum and minimum temperatures recorded in Avon over the period of the study. For each infant who had died and for each control infant these temperatures were recorded for the 24 hours preceding the death or the home visit respectively.

All the infants who had died were discussed at a confidential meeting, at which the history and pathological findings (including histological, biochemical, and microbiological findings) were discussed. Each of the infants was then assigned to one of two groups for the purpose of this study: group 1 comprised infants for whom a full and sufficient explanation of their death was found by pathological examination and group 2 comprised infants for whom a full and sufficient explanation was not found, though some abnormalities that might have been contributory were identified in many infants. Group 2 thus equates to infants who had died from the sudden infant death syndrome.

We tabulated the information on the infants' bedding and clothing and then calculated the total thermal resistance using published values for the thermal resistance of each material.[4,12] These values were expressed in tog units (the tog value of a fabric is defined as 10 times the temperature difference in degrees Celsius between its two faces when the heat flow is equal to 1 W/m$^2$). We estimated the proportion of the infant's surface area covered by each garment or item of bedding, and these values were used to calculate an effective total thermal resistance for the coverings on each infant. The estimates of surface area covered by each garment were based on data produced by the International Standards Organisation for adult clothing modified by factors relating proportional surface areas of body parts in infants and adults.[13-16] Blankets and other bedding were assumed to cover 80% of the infant's surface area unless the infant was reported to have been completely covered. Swaddling was assumed to increase the effective thermal resistance of the swaddling bedding by a factor of two. The data on thermal resistance of bedding and clothing and on the proportional covering by various garments were supplied by the Shirley Institute, Manchester (E Clulow, personal communication).

Statistical methods used were the $\chi^2$ method of discordant triplets, the Mantel-Haenszel test for comparing an index case with two matched controls, and multiple logistic regression for an index case and two controls.[17] The study was approved by the hospital ethical committees in the participating districts.

TABLE I—*Distribution of ages of infants who had died and control infants. Values are numbers (percentages)*

| Age (weeks) | Infants who had died (n=72) | Control infants (n=144) |
|---|---|---|
| -4 | 6 (8) | 10 (7) |
| -8 | 18 (25) | 28 (19) |
| -12 | 11 (15) | 24 (17) |
| -16 | 13 (18) | 34 (24) |
| -20 | 8 (11) | 16 (11) |
| -24 | 5 (7) | 12 (8) |
| -28 | 6 (8) | 8 (6) |
| -32 | 5 (7) | 12 (8) |
| >32 | | |

## Results

Seventy two unexpected infant deaths that occurred from November 1987 to April 1989 were included in the study. A further six unexpected deaths occurred of infants normally resident in the area, but were not included because of the absence of one of the investigators (four infants) or because the death had occurred while the infant was outside the study area (two infants). Results are given for the 72 deaths and 144 control infants.

Most families of the infants who had died were seen within 24 hours of the death (50), and all were seen within 72 hours. The median time from the death of the index infants until the control infants were seen was two days (92 were seen within three days and 129 within seven days).

The mean ages of the index and control infants were close (94·4 and 97·0 days respectively) (table I). The mean age of the two control infants was within 10 days of the age of the dead infant for 65 dead infants, and within three days for 35.

The minimum temperatures in the 24 hours before the control infants were seen were close to those in the 24 hours preceding the deaths of the index infants. In 48 cases the temperature difference was less than 3°C and in 54 it was less than 4°C. The median temperature difference was 1°C, with the temperatures being lower in the periods before the controls were seen.

There was a weak negative relation between the minimum outside temperature in the preceding 24 hours and the total thermal resistance of applied bedding and clothing for both the infants who had died and the controls, with a wide scatter at all temperatures.

Table II shows the relation between social class (according to the Registrar General's classification) and total thermal resistance for bedding and clothing. Among the controls there was a slight social class gradient with infants in social classes IV and V tending to have higher values than those in social classes I and II. This gradient was not apparent among the infants who had died, for whom values of total thermal resistance were slightly higher for all social classes.

From the information collected on signs of illness in the preceding 24 hours[18] infants were identified who had shown signs of illness that have been considered to be potentially serious.[19] These signs included difficulty breathing, frequent coughing (>5 bouts in 24 hours), diarrhoea, vomiting, high temperature, irritability, lethargy, and missing more than one feed. Such signs were reported by the parents of 16 of the 72 infants who had died and 14 of the 144 controls (odds ratio=2·4,

TABLE II—*Mean (SD) total thermal resistance of clothing and bedding (tog) for infants who had died and for control infants by social class*

| Social class | Infants who had died | Control infants |
|---|---|---|
| I and II | 8·57 (3·95) (n=15) | 7·25 (2·77) (n=41) |
| III | 9·17 (2·7) (n=27) | 8·26 (2·81) (n=66) |
| IV and V | 8·67 (3·09) (n=9) | 8·44 (3·16) (n=23) |
| Unknown or unclassifiable | 10·18 (4·45) (n=21) | 7·5 (3·01) (n=14) |

TABLE III—*Position in which infants had been put down to sleep*

| Position | Infants who had died (n=67) | Control infants* (n=134) |
|---|---|---|
| Prone | 62 | 76 |
| Side | 4 | 32 |
| Supine | 1 | 23 |
| Unknown | | 3 |

*$\chi^2$ Test for discordant triplets. Relative risk 8·8 comparing prone with other positions (95% confidence interval 7·0 to 11·0, p<0·001).

TABLE IV—*Tog values for bedding and clothing for infants who had died and their matched controls. Figures are numbers (percentages)*

| Tog value | Infants who had died (n=64) | Control infants (n=134) |
|---|---|---|
| 2 | 1 (2) | 2 (1) |
| 4 | 4 (6) | 8 (6) |
| 6 | 7 (11) | 35 (26) |
| 8 | 12 (19) | 34 (25) |
| 10 | 11 (17) | 22 (16) |
| 12 | 18 (28) | 21 (16) |
| 14 | 6 (9) | 8 (6) |
| 16 | 3 (5) | 3 (2) |
| 18 | 1 (2) | 1 (1) |
| 20 | 1 (2) | |

TABLE V—*Tog values for bedding and clothing among infants who had slept in prone position. Figures are numbers (percentages)*

| Tog value | Infants who had died (n=59) | Control infants (n=76) |
|---|---|---|
| 2 | 1 (2) | 2 (3) |
| 4 | 3 (5) | 5 (7) |
| 6 | 6 (10) | 20 (26) |
| 8 | 12 (20) | 19 (25) |
| 10 | 11 (19) | 16 (21) |
| 12 | 15 (25) | 9 (12) |
| 14 | 6 (10) | 4 (5) |
| 16 | 3 (5) | 1 (1) |
| 18 | 1 (2) | |
| 20 | 1 (2) | |

95% confidence interval 1·1 to 5·1, $\chi^2$=5·4, p=0·02 by Mantel-Haenszel test). Values obtained for the total thermal resistance of bedding and clothing for the infants who had potentially serious signs were no different from the values for those without such signs for either the infants who had died (mean 9·3 and 9·1 tog respectively) or the control infants (mean 7·8 and 8·1 tog respectively).

After pathological investigation a full explanation was found for the deaths of five infants (severe gastroenteritis and dehydration, septicaemia, haemorrhagic disease, perforated stomach, and Down's syndrome with atrioventricular canal defect and cardiac failure). These infants were therefore assigned to group 1. Four of these infants had shown major signs of illness in their last 24 hours. Values obtained for the total thermal resistance of clothing and bedding for the five infants in group 1 (median 8·7 tog, range 5·6 to 12·2 tog) were no different from those for the 67 infants in group 2, whether they had signs of illness (mean 8·65, SE 0·67 tog) or not (mean 9·1, SE 0·43 tog).

For the detailed analysis of the effects of sleeping position and total thermal resistance of bedding plus clothing only the 67 infants in group 2 (that is, those who died from the sudden infant death syndrome) and their controls were considered. Complete data on bedding and position for the index infant and the two control infants were available for 62 of the 67 infants who had died. Table III shows the positions in which the infants had been put to sleep. Sixty two of the index infants had been put to sleep prone and for 60 this was their usual sleeping position. Of 134 controls, 76 had been put to sleep prone. This difference was highly significant ($\chi^2$ test for discordant triplets, relative risk 8·8, 95% confidence interval 7·0 to 11·0, p<0·001).

Table IV shows the calculated values for total thermal resistance of bedding and clothing for the infants who had died and the control infants. The infants who had died were more heavily wrapped than the control infants (mean thermal resistance for infants who had died was 9·1 *v* 8·0 tog for control infants). The mean difference in thermal resistance of bedding and clothing between the value for the infants who had died and the mean value for their matched controls was 1·1 tog (95% confidence interval 0·15 to 2·2, p=0·025, paired *t* test).

After allowing for the difference in sleeping position between the infants who had died and controls the difference in thermal resistance of bedding plus clothing was significant by multiple logistic regression (relative risk associated with each 1 tog rise above 8 tog was 1·14, 95% confidence interval 1·03 to 1·28, p<0·05). A further multiple logistical regression was performed to examine the interaction between thermal resistance of bedding and clothing and sleeping position for three ranges of thermal resistance (<6 tog, 6-10 tog, >10 tog). This showed that the prone position and thermal resistance >10 tog were independently associated with an increased risk of sudden unexpected infant death, with relative risks of 7·39 (2·57 to 21·2, p<0·001) and 7·89 (2·51 to 24·8, p<0·001) respectively when compared with supine or side position and thermal resistance <6 tog respectively. Thermal resistance of bedding plus clothing in the range 6-10 tog was not associated with an increased risk of sudden unexpected infant death (relative risk 1·95, 0·83 to 4·54, p>0·05).

Table V shows the total thermal resistance for bedding and clothing for those infants who had been put to bed prone. The differences between the infants who had died and the control infants increased, with a greater proportion of the dead infants having been both prone and under excessive thermal insulation. All of the 11 infants who had died and had had a total thermal resistance of clothing plus bedding greater than 12 had been prone. Of the 12 control infants who had had values greater than 12 tog, seven had been supine or on their sides ($\chi^2$ with Yates's correction 6·674, p<0·01).

Among the control infants a higher proportion of those with more bedding had slept supine or on their sides than prone (for example, 35% (19) of infants who had slept supine or on their side had had bedding plus clothing with a total thermal resistance of more than 10 tog, compared with 18% (14) of prone infants). Such a breakdown of positions was not possible for the infants who had died because few of them had been either supine or on their sides.

The heating had been left on all night in the homes of a significantly higher proportion of the infants who had died (28 of 67) than of the control infants (34 of 134) ($\chi^2$ for discordant triplets, relative risk 2·7, 95% confidence interval 1·4 to 5·2, p<0·01).

The weights of the dead infants at necropsy were lower than those of the matched controls, though detailed assessment of the preceding growth charts did not suggest that there had been an appreciable weight loss before death. The mean difference in weight between the value for the infants who had died and the mean value for the two controls was 660 g (95% confidence interval 180 to 1140, p<0·01). These data will be reported in full elsewhere. In view of the difference in weight between the two groups we examined the relation between the total thermal resistance of bedding and clothing and the infants' weight for both the infants who had died and the control infants. The control infants showed no significant relation between weight and total thermal resistance of bedding and clothing, but the infants who had died showed a weak but significant positive correlation (r=0·31, p<0·01). Similarly, there was no significant relation between the values of total thermal resistance for clothing plus bedding and age for the controls but there was a significant positive correlation for the infants who had died (r=0·42, p<0·001). Thus the older infants who had died suddenly and unexpectedly (who also had been heavier) had been more heavily wrapped than the younger infants.

Because of the bimodal distribution of the ages of the infants who died (table I) the analysis of the effects of sleeping position and the quantity of bedding was repeated for the younger (<70 days) and older (≥70 days) infants separately. This analysis showed that for the younger infants for whom complete data were available there was no significant difference in total thermal insulation of bedding plus clothing between the infants who had died (n=24) and the control infants ($\chi^2$=0·75, p>0·05) whereas the prone position was associated with an increased risk of sudden unexpected infant death ($\chi^2$=7·14, relative risk 4·15, 95% confidence interval 1·32 to 13·04, p<0·01). For the older infants for whom complete data were available there had been a highly significant excess of bedding and clothing on the infants who had died (n=38) compared with control infants. The mean difference in thermal resistance of bedding plus clothing between the value for the infants who had died and the mean value for their controls was 2·39 tog (paired *t* test p<0·01). There was a significant association between prone position and the risk of sudden unexpected infant death ($\chi^2$=13·9, relative risk 9·81, 2·05 to 46·95, p<0·001).

A multiple logistical regression was performed on data from these infants to assess the interaction between sleeping position and values of thermal resistance in the three ranges previously investigated for the whole group (<6 tog, 6-10 tog, >10 tog). For the prone position compared with the side or supine position the relative risk was 15·1 (2·6 to 89·6, p<0·001). For thermal resistance of bedding plus clothing >10 tog compared with thermal resistance <6 tog the relative risk was 25·2 (3·7 to 169·0, p<0·001). Values of thermal resistance in the range of 6-10 tog were not associated with an increased risk (relative risk 4·3, 0·9 to 21·0, p>0·05).

## Discussion

The relation between overheating and the sudden infant death syndrome has been suggested previously, but the evidence has been mainly anecdotal.[1-3] Our study has shown that among a defined population of infants those who died were more heavily wrapped than control infants of the same age and in the same community seen shortly after the death of the index infants. In addition to the excess of clothing and bedding on the infants who had died a higher proportion of them had been in rooms in which the heating was on all night.

Wailoo *et al* showed a weak negative correlation between room temperature and quantity of bedding.[4] Because of the nature of our study we were unable to investigate this relation directly but used outside temperature as an indirect measure of the likely thermal environment in the bedroom; several authors have shown a direct relation between the outside temperature and room temperature.[4 9 10] On average the days on which the infants died were slightly warmer than the days on which the controls were seen, suggesting that their bedrooms may also have been warmer. Thus the effects of the relative excess of clothing and bedding on the infants who died were likely to have been greater.

This study also confirmed the observations of other investigators that there is an association between the prone position and the sudden infant death syndrome. In our study so few of the infants who had died had been supine or on their sides that we were unable to look in detail at the ways in which these positions interacted with other factors.[20 21] In the prone position the exposed surface area of the baby that can contribute to radiant heat loss is less than that in the supine position.[16 22] In the prone position infants are also more likely to tolerate bedding rising up and covering part or all of their heads than in the supine or side position, as in these latter positions the bedding will make contact with the malar region, which is very sensitive to changes in physical contact, particularly during rapid eye movement sleep.[23] For an infant who is heavily wrapped in a cot, 85% of total heat loss may be through the head,[4 6] and thus partially or completely covering the head is likely to have a considerable effect on the infant's thermal balance and may lead to an inability to lose heat and thus to overheating. Spontaneous movements by infants are more likely to lead to the covers rising up over them in the prone position than in the supine or side position, in which the bedding may be thrown off by the same types of movements.

We have thus confirmed the theoretical suggestion by Nelson *et al* that when there is excess bedding the risk of sudden unexpected death is higher for infants who are prone.[6] This risk is likely to be further increased if the metabolic rate rises, such as normally happens by 1 or 2 months of age.[7] Other factors that increase metabolic rate, such as acute viral infections, are also likely to increase the risk of overheating. Previous studies have shown a high correlation between the presence of signs suggestive of acute viral infections and sudden infant death syndrome.[19 24] In the present study some evidence of such an association was found, but many of the control infants had similar signs to those of the infants who had died.

Although two previous studies have shown that many parents respond to perceived illness in their infant by increasing the bedding,[9 10] we found no such trend. In New Zealand parents with higher educational achievements wrapped their babies more than those with lower achievements,[10] whereas in Exeter the reverse was true.[9] Among the control infants in our study a trend was seen of less wrapping in the higher socioeconomic groups, as in Exeter. Among the infants who had died, however, there was no such trend, suggesting that the subgroup of parents from social classes I and II who tended to overwrap their infants were overrepresented among the parents of infants who had died.

Unexpected findings were that among the infants who had died the older infants tended to be more heavily wrapped than the young ones, though no such trends were noted among the control infants, and that the increased risk of sudden unexpected death with overwrapping was significant for only the older infants. The higher ratio of mass to surface area in the older infants, together with their higher metabolic rates, may make them more vulnerable to the effects of increased thermal insulation. There is no reason to believe that the parents of the infants who had died had increased the amounts of bedding or clothing on their infants with increasing age. Thus the same degree of overwrapping, particularly in the prone position, may be more hazardous to these slightly older infants particularly when they have mild viral infections, which are commonly present in older infants who die suddenly and unexpectedly.

Reliable information on what constitutes appropriate thermal care for normal infants beyond the first month of life is scarce and many sources of information for parents and for health care professionals emphasise the risk of cold stress but say little about overheating. For infants who sleep on their sides or supine the effects of excess bedding may be less than for infants who sleep prone, and some may think that this warrants widespread adoption of the recommendation that all infants should be put to sleep supine or on their side. Infants who are supine are potentially more vulnerable to the effects of cold stress than infants who are prone,[16] and gastro-oesophageal reflux is more common and more severe in the supine position.[25] In newborn preterm infants oxygenation is better in the prone position than the supine position,[26] but little is known about this in older infants.

For infants with gastro-oesophageal reflux and preterm infants the prone position is preferable. For other infants the most appropriate sleeping position may be on their side or supine. For all infants particular attention should be paid to thermal care and the avoidance of heat stress. Parents should be encouraged to check whether their babies feel hot or cold and to adjust the bedding accordingly. This may be easier if multiple thin layers of bedding are used (for example, blankets) rather than a single thick covering (for example, a duvet). Educating parents about sleeping position for and correct thermal care of their babies may help reduce the incidence of sudden infant deaths.

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1 Bacon CJ. Overheating in infancy. *Arch Dis Child* 1983;58:673-4.
2 Stanton AN, Scott DJ, Downham MAPS. Is overheating a factor in some unexpected infant deaths? *Lancet* 1980;i:1054-7.
3 Stanton AN. Overheating and cot death. *Lancet* 1984;ii:1199-201.
4 Wailoo MP, Petersen SA, Whittaker H, Goodenough P. The thermal environment in which 3-4 month old infants sleep at home. *Arch Dis Child* 1989;**64**:600-4.
5 Lee NNY, Chan YT, Davies DP, Lau E, Yip DCP. Sudden infant death syndrome in Hong Kong: confirmation of low incidence. *Br Med J* 1989;**298**:721.
6 Nelson EAS, Taylor BJ, Weatherall IL. Sleeping position and infant bedding

may predispose to hyperthermia and the sudden infant death syndrome. *Lancet* 1989;i:199-201.
7 Azaz Y, Fleming PJ, Levine MR, McCabe R. The relationship between environmental temperature, metabolic rate and sleep state in infants from birth to two months [Abstract]. *Early Hum Dev* 1989;**18**:293.
8 Levine MR, Fleming PJ, Azaz Y, McCabe R. Changes in breathing pattern accompanying environmental cooling in human infants [Abstract]. *Early Hum Dev* 1989;**19**:216.
9 Eiser C, Town C, Tripp J. Dress and care of infants in health and illness. *Arch Dis Child* 1985;**60**:465-70.
10 Nelson EAS, Taylor BJ. Infant clothing, bedding and room heating in an area of high postneonatal mortality. *Pediatric and Perinatal Epidemiology* 1989;3: 146-56.
11 Gilbert R, Orrefu V, White DG, Berry PJ, Fleming PJ, Rudd PJ. Detection of alpha-interferon in babies dying suddenly and unexpectedly. *Pediatric Reviews and Communications* (in press).
12 Clulow E. Thermal insulating properties of fabrics. *Textiles* 1978;**1**:2.
13 International Standards Organisation Working Group. *Draft report on thermal environments*. Geneva: ISO, March 1986. (ISO/TVC/159/SC5/WGC.)
14 Boyd E. *The surface area of the human body*. Minnesota: University of Minnesota Press, 1935:113-42.
15 Klein AD, Scammon RE. The regional growth in surface area of the human body in prenatal life. *Proceedings of the Society of Experimental Biology* 1930;**27**:463-6.
16 Stothers JK, Warner RM. Thermal balance and sleep state in the newborn. *Early Hum Dev* 1984;**9**:313-22.
17 Osborn JF. *Basic statistical methods for epidemiological studies*. London: London School of Hygiene and Tropical Medicine, 1987.
18 Gilbert RE, Fleming PJ, Azaz Y, Rudd PT. Signs of illness preceding sudden unexpected death in infants. *Br Med J* 1990;**300**:1237-9.
19 Stanton AN, Downham MAPS, Oakley JR, Emery JL, Knoweldon J. Terminal symptoms in children dying suddenly and unexpectedly at home. *Br Med J* 1978;ii:1249-51.
20 Jonge GA, Engelberts AC, Koomen-Liefting AJM, Kostense PJ. Cot death and prone sleeping position in The Netherlands. *Br Med J* 1989;**298**:722.
21 Beal S. Sleeping position and SIDS. *Lancet* 1988;i:688.
22 Wheldon RE. Energy balance in the newborn baby: use of a mannikin to estimate radiant and convective heat loss. *Phys Med Biol* 1982;**27**:285-96.
23 Fleming PJ, Levine MR, Goncalves A. Changes in respiratory pattern resulting from the use of a facemask to record respiration in newborn infants. *Pediatr Res* 1982;**16**:1031-4.
24 Knowelden J, Keeling J, Nichol JP. *A multicentre study of post-neonatal mortality*. London: Department of Health and Social Security, 1984.
25 Orenstein SR. Effect of non-nutritive sucking on infant gastro-esophageal reflux. *Pediatr Res* 1988;**24**:38-40.
26 Orenstein SR, Whittington PF, Orenstein DM. The infant seat as treatment for gastroesophageal reflux. *N Engl J Med* 1983;**309**:760-3.
27 Martin RJ, Herrell N, Rubin D, Fanaroff A. Effect of supine and prone positions on arterial oxygen tension in the preterm infant. *Pediatrics* 1979;**63**:528-31.

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# Sources of stress in women junior house officers

Jenny Firth-Cozens

## Abstract

***Objective*—To determine the causes of stress in women doctors and relate these to levels of depression.**

***Design*—Questionnaire study.**

***Subjects*—Of 92 women doctors who had graduated from the universities of Leeds, Manchester, and Sheffield in 1986 and had been working as junior house officers for eight months 70 (76%) returned completed questionnaires.**

***Main results*—Mean score on the general health questionnaire was 13·79 (SD 5·20) and on the symptom checklist for depression was 1·43 (0·83). The scores of 32 subjects (46%) were above the criterion for clinical depression. Overwork was perceived as creating the most strain, followed by effects on personal life, serious failures of treatment, and talking to distressed relatives. Both stress and depression were related to effects on personal life, overwork, relations with consultants, and making decisions. Sex related sources of stress were conflicts between career and personal life, sexual harassment at work, a lack of female role models, and prejudice from patients. In addition to these, discrimination by senior doctors was related to depression.**

***Conclusion*—Changes are needed in the career paths of women doctors, and could be implemented.**

## Introduction

Symptoms of stress and depression have been found to be high in junior doctors, both in Britain[1] and in North America,[2-4] and these findings are true for both men and women. Several studies have shown, however, that the stress and depression levels of women doctors are considerably higher than those of other professional women[5] and of male doctors[1 2]; for example, in a study of junior house officers, Hsu and Marshal found that women were one and a half times more likely to be classified as depressed and eight times more likely to be severely depressed.[2]

In addition, women doctors in general have been reported to have suicide rates of up to four times those of their age mates.[7] Though it is always difficult to compare relatively small groups with the general population, a recent Swedish study used a 10 year sample and comparisons with academics to find that women doctors had higher suicide rates when compared with both the general population and women academics, while men doctors had rates equal to the general population and higher than those of academics.[8]

Although higher levels of occupational stress have been reported in women generally,[9] a recent meta-analysis of comparisons of male and female workers showed no differences.[10] Notman *et al* found no sex differences at intake to medical school,[11] and a British longitudinal study showed that there were no sex differences in stress or depression when the subjects were students but that higher rates of depression existed when they were junior house officers.[1 12] Despite any difficulties in interpretation, it seems clear that women doctors are an occupational group at risk for depression and suicide and it is particularly important to attend to possible reasons for these differences.

Studies comparing men and women junior doctors on work factors have found similar scores for satisfaction with career choice, perceived competence, and reported levels of fatigue,[6] and no differences have been reported on job perceptions or sources of stress.[1 13] Studies looking specifically at women doctors, however, have reported stress arising from career and family conflict,[14-16] prejudice,[5 17] and a lack of role models.[14] A recent British study that categorised accounts of stressful events of male and female junior house officers found not one account of such problems, but this may have been because this method reports acute rather than chronic stressors.[13] I therefore considered the perceived causes of stress in women doctors in more detail and related these to levels of depression.

## Method

A list of hospital addresses of preregistration doctors who had graduated from the universities of Leeds, Manchester, and Sheffield in 1986 was provided by the postgraduate offices of those universities as part of the junior doctors project.[1] The 92 women doctors who had not been contacted previously under that project were sent postal questionnaires and stamped addressed envelopes along with a letter explaining that this was a

**Department of Psychology, University of Leeds, Leeds**
Jenny Firth-Cozens, PHD, *clinical psychologist*

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